

## REMARKS

### A. Background

Claims 5-12 were pending in the application at the time of the Office Action. The Office Action rejected all of claims 5-12 as being obvious over cited art. By this response Applicant has amended claims 5-12. As such, claims 5-12 are presented for the Examiner's consideration in light of the following remarks.

### B. Examiner Interview

Initially, Applicant would like to thank the Examiner for the courtesy of the telephone interview conducted on December 12, 2006. During the interview, the claimed embodiments of the invention were discussed and contrasted with the cited art (U.S. Patent No. 6,362,515 to Hayakawa ("*Hayakawa*")). The Examiner agreed that in contrast to the claimed invention in which the buffer layer promotes vertical growth of a nitride semiconductor, the preventing means of *Hayakawa* prevents vertical growth of the nitride semiconductor on the buffer layer of *Hayakawa*. The Examiner stated that adding a limitation to the pending claims that a nitride semiconductor is vertically grown on the substrate would differentiate the claims over *Hayakawa* and thereby overcome the obviousness rejection set forth in the outstanding Office Action. In response thereto, Applicant has herein amended claims 5-12 to include such a limitation. During the interview, the Examiner also stated that there were some informalities in the claims that needed to be addressed to avoid possible indefiniteness issues. Accordingly, claims 5-12 have also been amended to address these informalities.

C. Proposed Amendments

By this response, Applicant has amended claims 5-12 to add the limitation that a nitride semiconductor is vertically grown on the buffer layer or cap layer, as discussed in the Examiner Interview noted above. Support for these amendments can be found in the specification as originally filed at least in Figures 2 and 6 and the accompanying discussion, in which a GaN layer is clearly vertically grown on the substrate buffer layer. Claims 5-12 have also been amended to clarify claim language and to prevent possible indefiniteness issues as discussed in the aforementioned Examiner Interview. For example, the claims are now directed to a substrate system so as to differentiate over the sapphire substrate recited therein. Also, formerly dependent claims 6 and 12 have been rewritten to be independent claims including all of the limitations recited in the claims from which claims 6 and 12 previously depended. In view of the foregoing, Applicant respectfully submits that the amendments to the claims do not introduce new matter and entry thereof is respectfully requested.

D. Rejection on the Merits

Pages 2 and 3 of the Office Action reject claims 5-12 under 35 USC § 103(a) as being obvious over *Hayakawa* in view of what the examiner considers to be obvious to those skilled in the art. This rejection is essentially a repeat of the rejection set forth in the previous Office Action dated January 18, 2006. Specifically, the Office Action asserts that *Hayakawa* discloses multiple films, including Al<sub>2</sub>O<sub>3</sub>, AlN, and AlON, “stacked in any combination on a substrate, which may be a sapphire substrate.” The Office Action further asserts that “[b]ecause *Hayakawa* discloses all of the films claimed and discloses that they may be arranged in any manner, it

would have been obvious ... to create the claimed structures.” Applicant respectfully traverses this rejection.

Applicant respectfully notes at the outset that in order to establish a *prima facie* case of obviousness, it is the burden of the Examiner to demonstrate that three criteria are met: first, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings; second, there must be a reasonable expectation of success; and third, the prior art reference (or references when combined) must teach or suggest all the claim limitations. MPEP § 2143.

As noted in the previous response and perhaps best shown in Figure 1B, *Hayakawa* discloses stripe structures having a GaN buffer layer 12, a first GaN layer 13 and a SiO<sub>2</sub> layer 14. Grooves are formed between the stripe structures and a “first preventing means” and “second preventing means” are formed on the upper surfaces of the stripe structures and the grooves, respectively. See col. 3, lines 22-29. The first preventing means and the second preventing means can be realized by a dielectric film 18. See Figure 1B and col. 3, lines 53-55 and 61-63. Although not shown in any of the figures, *Hayakawa* asserts that, along with other possible film combinations, the dielectric film 18 may be made of Al<sub>2</sub>O<sub>3</sub>, AlON or AlN. Alternatively, *Hayakawa* asserts that the dielectric film 18 may be a multilayer film made of any combination of the above films. See col. 4, lines 10-17.

The purpose given in *Hayakawa* for the “first preventing means” is “for preventing crystal growth of a GaN layer in the vertical up direction from the upper surfaces of the plurality of stripe portions.” Col. 3, lines 22-26. Similarly, the purpose given in *Hayakawa* for the “second preventing means” is “for preventing crystal growth of a GaN layer in the vertical up

direction from the ... bottom [of the grooves]." Col. 3, lines 26-29. That is, in *Hayakawa*, vertical crystal growth on the layered substrate is effectively prevented by the dielectric film 18. See column 3, lines 57-60 and 64-67. *Hayakawa* does this so that only a lateral crystal growth of a second GaN layer 16 from the exposed side walls of the stripe structure of the first GaN layer 13 will occur. See col. 4, lines 1 to 9; col. 6, lines 64-67; col. 7, lines 58-60; col. 8, lines 41-46, 49-52.

Because *Hayakawa* only discloses GaN being grown laterally from the layered substrate and expressly teaches preventing vertical crystal growth, Applicant respectfully submits that *Hayakawa* does not disclose or suggest:

- "a second layer including N, O and Al ... on which a nitride semiconductor layer is vertically grown," as recited in amended claim 5, or
- "a cap layer made of Al<sub>2</sub>O<sub>3</sub> ... , the nitride semiconductor being vertically grown on the cap layer," as recited in amended claim 6, or
- "a vertically grown nitride semiconductor layer provided on or above the second layer," as recited in amended claim 7, or
- "a vertically grown nitride semiconductor layer provided on or above the AlN layer," as recited in amended claim 9, or
- "a second layer including N, O and Al, ... the second layer being disposed against a vertically grown nitride semiconductor layer," as recited in amended claim 11, or
- "a cap layer made of Al<sub>2</sub>O<sub>3</sub> ... , the nitride semiconductor being vertically grown on the cap layer," as recited in amended claim 12.

Furthermore, because *Hayakawa* expressly teaches preventing vertical crystal growth from the layered substrate, there is no motivation to modify *Hayakawa* to incorporate a nitride semiconductor that is vertically grown on the substrate since such a modification would destroy the intended function and operation of *Hayakawa*. In view of the foregoing, applicant submits that claims 5-7, 9, 11, and 12 are not obvious over the cited art. Accordingly, Applicant respectfully requests that the obviousness rejection with respect to claims 5-7, 9, 11, and 12 be withdrawn.

Claims 8 and 10 depend from claims 7 and 9, respectively, and thus incorporate the limitations thereof. As such, Applicant submits that claims 8 and 10 are distinguished over the cited art for at least the same reasons as discussed above with regard to claims 7 and 9. Accordingly, Applicant respectfully requests that the obviousness rejection with respect to claims 8 and 10 also be withdrawn.

No other objections or rejections are set forth in the Office Action.

#### E. Conclusion

Applicant notes that this response does not discuss every reason why the claims of the present application are distinguished over the cited art. Most notably, applicant submits that many if not all of the dependent claims are independently distinguishable over the cited art. Applicant has merely submitted those arguments which it considers sufficient to clearly distinguish the claims over the cited art.

In view of the foregoing, applicant respectfully requests the Examiner's reconsideration and allowance of claims 5-12 as presented herein. In the event there remains any impediment to

allowance of the claims which could be clarified in a telephonic interview, the Examiner is respectfully requested to initiate such an interview with the undersigned.

Dated this 18<sup>th</sup> day December 2006.

Respectfully submitted,

/Scott A. Woodbury/ Reg. # 55743  
SCOTT A. WOODBURY

Registration No. 55,743  
DANA L. TANGREN  
Registration No. 37,246  
Attorneys for Applicant  
Customer No. 022913  
Telephone No. 801.533.9800

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